THE CALIFORNIA RAILROAD INDUSTRY

February 23, 2009

Harold Holmes
California Air Resources Board
1001 I Street
P.O. Box 2815
Sacramento, CA 95812

RE: Railroad Comments on the ARB's Preliminary Draft Report, "Technical Options to Achieve Additional Emissions and Risk Reductions from California Locomotives and Railyards"

Dear Mr. Holmes:

The BNSF Railway, the Union Pacific Railroad Company, and the Association of American Railroads (the "Railroads") appreciate the opportunity to comment on the Preliminary Draft Report entitled "Technical Options to Achieve Additional Emissions and Risk Reductions from California Locomotives and Railyards," (the "Preliminary Draft") released by the ARB staff (the "Staff") in December 2008. In general, the Preliminary Draft is a useful guide for readers to begin to understand the potential and the limitations of new technologies and techniques for possible additional locomotive and railyard emissions reductions. We understand that ARB will consider the comments it receives and issue a further draft of the report later this year (the "Next Draft").

This letter sets forth our general comments to help round out and set the essential context for the Next Draft. The letter also provides the Railroads perspective on what information is crucial to be included in the Staff's update to the Board, planned for the June 2009 meeting. Attachment 1 to this letter provides a suggested framework for evaluating cost-effectiveness. Attachment 2 provides an initial page-by-page analysis of the Preliminary Draft, including specific comments, ideas, suggestions, and concerns.

General Comments

1) <u>The Preliminary Draft should not identify "High Priority Recommendations" or "Proposed Options</u>."

The stated purpose of the Preliminary Draft is "to provide a sound technical basis for the ongoing dialogue about how best to achieve further reductions" by evaluating "the technical feasibility, potential emissions reductions, costs, and relative cost-effectiveness" of each option. While useful, this analysis is premature because it does not provide a basis for selecting or prioritizing the options for implementation. Other factors must be considered in order to characterize the potential of any option, including the legal authority of various agencies to require specific measures and the availability and the magnitude of public funding. As the authors note, the Preliminary Draft:

> *"is not intended to serve as an implementation blueprint, as it does not evaluate which agency or agencies may have authority to implement such options. The document also does not evaluate what role, if any, the availability of public funding might play in assuring earlier or further reductions."*[1]

Only after considering these additional factors would one have the ability to fully evaluate the interdependencies and impacts of the various possible options. Without such evaluations, it will be impossible for the Board to understand the potential to achieve additional reductions from locomotives and railyards. Accordingly, any designation of technologies as potential "high-priority options" or "proposed options" should be left until after the Staff's next update to the Board, expected in June 2009.

2) <u>The Railroads' operations are fluid, so the Next Draft should specify that it is a living document, with each subsequent version serving as a snapshot at a particular point in time.</u>

As useful as the Preliminary Draft is, it only represents <u>a snapshot in time</u>. Locomotive fleet composition changes are constant and fluid, due to many factors, including fluctuations in cargo requirements, acquisition of new locomotives and market demands.

For example, by looking at Table ES-1 on page 3 of the Executive Summary, a reader could assume there were 152 older switch locomotives and 290 older medium horsepower (MHP) freight locomotives operating in California that would be candidates for various retrofit technologies.[2] While this fleet composition may have been operating in California at some point, it is clear from the numbers shown in the table below that there has been a significant change in the composition of the locomotive fleet over the course of the past year.

Staff concluded that the 152 switchers, combined with the 290 MHP units operated by the freight railroads at the time of this snapshot, meant that a pool of 442 freight units were available for retrofit. However, early February 2009 railroad data indicates that the combined UP and BNSF fleet of older switch and MHP locomotives operating in California totaled 120

[1] Technical Options to Achieve Additional Emissions and Risk Reductions from California Locomotives and Railyards, p. 1.

[2] Of the 400 MHP locomotives, 110 are passenger locomotives. The Preliminary Draft therefore assumes there are 290 MHP freight locomotives.

locomotives—or about 27 % of the fleet indicated in the Preliminary Draft. The table below provides a detailed breakdown of this February combined fleet.

	Union Pacific	BNSF	Total	% of Total Pre-Tier 0 Switch & MHP Fleet
Pre-Tier 0 Switch Locomotives	10	18	28	-
MHP Locomotives	12	80	92	-
Total Freight Locomotives	22	98	120	52%
Total Passenger Locomotives			110	48%
Total Pre-Tier 0 & MHP Locomotives			230	100%

The much lower number of such units operating in California is not significantly attributable to units being "parked" due to the sharp downtown in the business cycle in recent months. This fleet composition shift is due in large part to the ongoing modernization of both Railroads' national locomotive fleets. The oldest and least efficient units are being retired and usually replaced with fewer, more powerful, more reliable, and more fuel efficient locomotives.

This modernization of the fleet continues over time and has accelerated in recent years to ensure railroad compliance with the 1998 Railroad-ARB MOU in Southern California. For instance, even in these extremely difficult economic times, the Union Pacific and the BNSF have voluntarily committed to purchase an additional 425 new Tier 2 line haul locomotives in 2009 that will burn approximately 15% less fuel to do the same amount of work as the current fleet.[3]

Railroad Recommendations:

a. The Next Draft should clearly state that the fleet data in the report represents a snapshot in time—and that railroad fleets are expected to change further in the future.

b. The Next Draft should specify the assumptions made regarding the current and future characteristics of the locomotive fleet in California. The Next Draft should specify how many units of each locomotive class will operate in the California fleets over the short-term (five year) and mid-term (ten year) periods, which classes will be covered by the US EPA's new rebuilding standards for Tier 0 emissions levels, and how

[3] Boyd, John D. "Rails on a Cutting Edge", *Traffic World*, Febraury 2, 2009.

rebuilt units, with their attendant lower emissions, will affect the tons expected to be reduced from any additional investment program in these units.

c. The Next Draft should provide not only cost and benefit information on a fleet-wide basis, but should also provide per unit costs and benefits for the various options, so that the reader can determine the economic and environmental consequences of the various options for any range of fleet composition that may exist in the future. See Attachment 1 of this letter for a suggested table format for this information.

3) The Next Draft should use the Carl Moyer methodology for evaluating cost-effectiveness.

The Railroads believe it is essential to evaluate cost-effectiveness of possible options using the methodology required by the Carl Moyer Program (CMP), particularly with respect to the use of the Annual CMP Weighted Emissions Reductions (NOx+ROG+20*PM10) in tons per year. In the Executive Officer's letter to the Petitioners, dated January 20, 2009, the Railroads were pleased to see Staff agree that such an analysis needs to be completed in the Next Draft. While the initial total capital cost/total tons of emission reductions approach used in the Preliminary Draft is useful for illustrative purposes, the report should also provide cost-effectiveness estimates utilizing one commonly accepted methodology—the Carl Moyer methodology. Use of public funding will be crucial to the evaluation of the cost-effectiveness of the various options, thus use of a conventional methodology will be critical to the identification of the best alternative(s).

Once the revised cost-effectiveness analysis is completed in the Next Draft, the cost-effectiveness calculations in the Preliminary Draft that do not conform to the CMP should be deleted. We believe this will avoid the confusion or misunderstanding that will inevitably arise if there is more than one methodology in the document.

Railroad Recommendations:

a) The Next Draft should calculate cost effectiveness using the Carl Moyer Program (CMP) methodology.

b) Any cost-effectiveness calculations in the Preliminary Draft that do not conform to the Moyer methods should be deleted from the Next Draft.

4) In addition to evaluating cost-effectiveness using the Carl Moyer method, Staff should identify other costs, such as the cost of operating and maintaining a given technology.

While the Railroads support the use of the Carl Moyer methodology for determining cost effectiveness, we also recommend that the Next Draft present all of the costs associated with the operations and maintenance (O&M) of the various technologies. These O&M costs over the useful life of an investment are a significant consideration when the Railroads evaluate equipment purchases and the impact of public funding. Attachment 1 provides a suggested approach to examining these costs.

The table below helps illustrate some of our concerns. We assume for the purposes of this simplified example that all technologies have the same percentage reduction of pollutants and that the public funds match is limited to 50%.

Technology Options	**Capital Costs ($000)**	**O& M Costs ($000)**	**Total Costs ($000)**	**True Match Percentage if Public Funds = 50% of Acquisition Costs**
Option A	100	100	200	25%
Option B	100	50	150	33%
Option C	100	25	125	40%
Option D	100	12.5	112.5	44%

If one solely judged each option above by looking at the capital cost divided by the emission reductions (similar to the Carl Moyer program), each appears identical. However, when the true cost of the Railroad investment is incorporated (i.e., both the capital costs and the O&M costs are included) a different picture emerges. In each case, the true impact of a 50% acquisition cost match is considerably less, sometimes by as much as half. If the Next Draft fails to document the true costs (capital costs and O&M costs), some readers will not understand the whole picture and thus may draw incorrect conclusions about the potential attractiveness of one technology or another.

The Railroads would be pleased to work with Staff to develop an estimate of the various costs of the relevant technologies.

Railroad Recommendations:

a) The Next Draft should present all costs associated with the various technologies, including capital costs and O&M costs.

5) If an option proposes a combination of technologies, costs and cost-effectiveness should be presented separately for each technology.

   To guide limited investment dollars to the most cost-effective options and avoid confusion about what is meant by cost-effectiveness, each potential technology should be examined separately. This is because cost-effectiveness varies with the order in which options are implemented. For example, PM reductions can result from timing and in-cylinder changes, addition of diesel oxidation catalysts, and the addition of two or more types of diesel particulate filters. The costs and removal efficiencies of each of these technologies need to be determined, so that the incremental benefits of each can be evaluated. All costs of the technologies should be included in the Staff's analysis. See Attachment 1 for a suggested approach.

6) The comparative cost-effectiveness of various options should be clearly identified when Staff has identified a number of alternatives that would affect the same classes of locomotives.

   In considering options, Staff should also examine which options yield the greatest reductions for the least cost. Were one option to achieve substantial reductions at relatively modest cost, while another would achieve even higher reductions, but at disproportionately higher cost, the first option may be preferable. This would be especially true if the amount of available public funds were insufficient to cover the much higher capital costs of the more expensive option.

   Table ES-1 below from the Preliminary Draft illustrates the need for this more detailed financial analysis.

Table ES-1
Options to Accelerate Further
Locomotive Emissions Reductions

Option #	Near-Term Options (up to 5 years)	Emission Reductions Statewide (tons per day)		Cost-Effectiveness (NOx+PM) **	Costs (Millions)
		PM	NOx		
Locomotive Replacements or Engine Repowers					
1	Replace 152 older switch locomotives with new ULESL switch locomotives ($1.5 million/unit)	0.30	6.6	$2-5/lb (10-20 years)	$230
5	Repower 400 older MHP locomotives with new LEL engines ($1 million/unit); or	1.25	23.0	$1-2/lb (10-20 years)	$400
	SUBTOTAL	1.55	29.6	$1-5/lb	$630
6	A possible alternative to Option #2, replace up to 200 of the 400 older MHP locomotives with new MHP gen-set locomotives ($2 million/unit)	0.63	13.3	$2-4/lb (10-20 years)	$400
Locomotive Remanufacturing Options – Less Expensive Alternatives to Options #1 and #5					
4	Remanufacture 152 older switch locomotives to meet U.S. EPA Tier 0 Plus emission standards * ($250,000/unit)	0.22 *	2.2 *	$1-2/lb (10-20 years)	$38
8	Remanufacture 400 older MHP locomotives to meet U.S. EPA Tier 0 Plus emission standards * ($250,000/unit)	1.0 *	13.0 *	$0.50-1/lb (10-20 years)	$100
	SUBTOTAL	*1.22 **	*15.2 **	*$0.5-2.50/lb*	*$138*

* Note: Estimated emissions reductions are highly dependent on whether the railroads choose to remanufacture older locomotives.
** Cost-effectiveness ranges are based on10 to 20 years of useful life and may not add up precisely due to rounding.

Options 5 and 8 are both potentially available to retrofit MHP units. Staff has concluded that option 8 (remanufacturing locomotives to meet US EPA Tier 0 regulations) would achieve reductions of 13 tons of NOx and one ton of PM at a cost of $100,000,000. Option 5 (repowering the locomotives with LEL engines) would achieve reductions of 23 tons of NOx and 1.25 tons of PM for $400,000,000. Pursuing option 5 instead of option 8 would increase costs 300%, but would only achieve 77% additional NOx reductions and 25% additional PM reductions. Similarly, for older switch locomotives, pursuing option 1 rather than option 4 would require six times more funds, but achieve nowhere near six times the reductions that option 4 would.

The railroads believe that perhaps the clearest way to demonstrate this concept would be for the Next Draft to include a table similar to the one included as Attachment 1 to this letter. For each category of possible investments (older switch locomotives, MHP locomotives, retrofit of Gensets, etc.), the layers of potential technology investments, their costs, their useful life and their reductions could be displayed. That way the reader could immediately see both the benefits and the costs of each successive layer.

In the near-term (up to 5 years), under the best of circumstances, both the Railroads and the State expect to be operating under very constrained financial conditions. All parties should be interested in the best stewardship of these limited financial resources. Understanding the best use of limited financial resources relative to the reductions achieved—that is avoiding diminishing marginal returns for additional dollars invested—is critical to this process. Comparative analysis of increasingly expensive options that would potentially apply to the same class of locomotives will be an invaluable tool in identifying the best options to pursue.

7) The Next Draft should provide a more complete assessment of the relative pros and cons of various potential technology options and updates on the development of technologies.

The tables in the Preliminary Draft describe potential NOx and PM reductions and some of the first-time costs of the various options. However, there are many additional facts that decision makers and stakeholders will need to properly judge all aspects of possible options. These include:

- How might the various technologies affect fuel consumption?
- If the technologies cause a fuel penalty, how large would the increased GHG emissions be?
- How would the technologies affect reliability? Mean time to failure? Maintainability?
- How would various technologies negatively affect asset utilization?
- How would the technologies affect engine output rating or tractive effort?
- Which options, when compared to others, provide the greatest benefit to populations around railyards?
- Would interoperability between national railroads be impacted so that existing "run-through" operations would be hindered or even eliminated?

Also, various technologies presented in the Preliminary Draft are at different stages of development. Some (such as Gensets) are deployed, but data is still being gathered on reliability and maintenance requirements. Others (such as SCR) are currently limited to small-scale pilot studies with no large-scale, off-road Tier 4 engines undergoing endurance testing yet. To aid the reader's understanding of such technologies, the Railroads request that projected dates of technology availability be included and updated with each subsequent draft, based upon independent verification by ARB.

The answers to these questions as part of periodic updates will be essential to evaluating the most promising options and thereby informing investment decisions.

8) <u>Any estimates of statewide inventory used in the Next Draft should be consistent with ARB's statewide inventory.</u>

   The data contained in some of the figures and text of the Preliminary Draft does not appear to be consistent with the statewide inventory data on ARB's website. For example figure I-2 shows that in the year 2015, statewide locomotive NOx emissions are less than 100 TPD (after taking into account the 2008 EPA rulemaking shown by the pink line). However, in the ARB online inventory, the 2015 train inventory is 128.32 TPD. It is possible that the online inventory does not contain reductions from the 2008 EPA rulemaking.

9) <u>The Executive Summary should include a section that provides an overview of the California freight railroads and railyards emissions reductions, including those that have been achieved to date and those that are currently planned.</u>

   In order to set the context for the reader, the Railroads suggest that a section should be added to the executive summary of the Next Draft that details the considerable progress made in the past ten years. For example, the 1998 MOU, the 2005 MOU, especially the analytical framework of the HRAs, the 1998 and 2008 US EPA locomotive emissions rules, and various other actions and initiatives by the EPA, ARB, and the Railroads have and will continue to dramatically reduce emissions from locomotives and railyard facilities. Technology is constantly changing and evolving such that "today's best solution(s)" may be "tomorrow's second best."

   Before assessing what further reductions might be possible, the Staff should explain to the reader that substantial progress has been achieved. Such context setting is certainly warranted by the finding in the Preliminary Draft that:

   > *"Based on a technical assessment of eight UP and BNSF railyard mitigation plans, staff estimates that both existing regulatory and voluntary railroad measures for the 18 railyards will provide an average reduction of over 50 percent in railyard diesel PM emissions by as early as 2010, 65 percent by 2015, and 80 percent by 2020."*[4]

[4] Technical Options to Achieve Additional Emissions and Risk Reductions from California Locomotives and Railyards, p. 19.

Furthermore, these significant reductions will be achieved even when expected growth in rail operations was factored into the analysis.

In order for the readers to have an accurate perspective of what can be accomplished in the future, they must understand the Railroads' accomplishments to date.

Information that should be compiled and analyzed in or prior to the Staff Report for the Board's update on locomotive matters

1) An overview of emissions reductions achieved to date or planned from California's freight railroads and railyards.

   As noted above, before assessing what further reductions might be possible, the Staff should explain to the reader that substantial progress has been achieved by including a section in the Staff's update to the Board that details the 1998 MOU, the 2005 MOU, especially the analytical framework of the HRAs, the 1998 and 2008 US EPA locomotive emissions rules, and various other actions and initiatives by the EPA, ARB, and the Railroads that have and will continue to dramatically reduce emissions from locomotives and railyard facilities.

2) A discussion of the benefits of expanding the use of freight rail to reduce greenhouse gas emissions from the transportation sector.

   As the Railroads have noted in past comments to ARB throughout the AB 32 Scoping Plan development, ARB should be consistent in its overall strategy to promote efficiencies throughout the California economy and support the concept of encouraging the movement of more goods on rail. Supporting this concept is consistent with the logic behind other measures in the Plan, such as increasing the use of Combined Heat and Power technologies and the Plan's emphasis on co-benefits – since each train carries goods that would otherwise go by less efficient trucks on congested highways.

   Furthermore, US EPA published an ANPRM on regulating GHGs on July 30, 2008. A key point made by the US EPA in the ANPRM must not be overlooked: one method of controlling GHG is to increase the use of railroad transportation. In the ANPRM, US EPA observes:

> *"[Rail] transportation has already been the focus of substantial efforts to reduce its energy use, resulting in generally favorable GHG emissions per ton-mile or per passenger-mile.[5]"*

Diversion of traffic from trucks to railroads would lead to an overall decrease in GHG emissions, even though railroad GHG emissions would increase. This is due both to the railroads' fuel efficiency advantage and because diversion of traffic from highways reduces road congestion. As the US EPA recognizes in the ANPRM, mode shifting from truck to rail is a legitimate GHG reduction strategy.[6]

Environment Alberta, Alberta's Provincial equivalent of the ARB, examined the possibility of environmental benefits from this mode shifting strategy and concluded there are indeed benefits.

> *"This protocol provides a method for calculating the GHG emissions reductions that occur from shifting baseline truck freight transport to project rail freight transport in the Alberta context. <u>This activity results in emissions reductions given the significantly higher fuel consumption and associated GHG emission rates of trucks as compared to rail per amount and distance of freight shipped.</u>[7]"* [Emphasis added.]

Environmental, freight and passenger rail groups have recently come together with reform-minded transportation experts to form the OneRail coalition, with an aim to advance rail programs. The coalition will encourage public policies recognizing rail as a critical element of the national transportation system and an essential part of the future economic growth and environmental well-being of the nation. In the group's initial materials, Executive Director Peter Lehner of the Natural Resources Defense Council states:

> *"Rail should be a key element of any federal response to climate concerns. Improving surface transportation offers both immediate and long-term benefits by decreasing traffic*

[5] 73 Fed. Reg. 44464. 2007 data show that railroads move a ton of freight 436 miles on one gallon of diesel fuel. AAR calculates gallons per revenue ton mile by averaging the data for the Class I railroads, submitted annually by the Class I railroads to the Surface Transportation Board on "R-1" reports. In the R-1 reports, schedule 750 contains the fuel data and schedule 755 contains the ton-mile data. While EPA states that railroads move a ton of freight 423 miles on one gallon of diesel fuel, more recent data show that the railroads move a ton of freight 436 miles per gallon of fuel.

[6] 73 Fed. Reg. 44464. EPA's SmartWay program gives credit to shippers using railroad intermodal service.

[7] QUANTIFICATION PROTOCOL FOR FREIGHT MODAL SHIFTING, Alberta Environment
http://environment.alberta.ca/documents/Modal_Freight_Shift_Protocol_v1_May_08.pdf

congestion, helping to mitigate rising energy costs and reducing emissions related to global warming. We hope Congress will move quickly on these critical issues."[8]

3) Assessment of the legal authority of different agencies to regulate locomotive emissions.

   This assessment should follow prior ARB analyses and established precedents.

4) Assessment of what public funds might be available to accelerate reductions.

   This assessment should describe which funds and what options the Staff believes merit consideration for public investments.

5) The completed Next Draft of this report, as informed by recommendations and feedback provided in this letter and by other stakeholders.

Conclusion

We appreciate the effort that the ARB Staff has expended to create this Preliminary Draft and the opportunity to provide these comments. We hope our comments will help make the Next Draft an even more useful document for decision makers. Please call me at 415-421-4213 x12 if you have any questions or comments about this letter.

Sincerely,

Kirk Marckwald

Kirk Marckwald
On behalf of the California Railroad Industry

cc: Mary Nichols
James Goldstene
Ellen Peter
Mike Scheible
Bob Fletcher
Dean Simeroth

[8] http://www.aar.org/NewsAndEvents/PressReleases/2009/01/011509_OneRail.aspx

Attachment 1

#	GROUP DESCRIPTOR		PER UNT DATA								YRs	CE in $/CMP TON*		STATEWIDE TOTALS				NOTES
			COST, $x10^6			NOx	PM											
#	BASE LOCOMOTIVE	NEW TIER	CAPIT-AL	O&M	TOT-AL	G/BHp-Hr		FUEL** gpy	NOx tpy	PM tpy		CAPITAL ONLY	TOTAL COSTS PM tpy	# OF UNITS	COST in $	NOx tpy	PM tpy	
1	GP-38 (Pre-0)					17.4	0.44	50,000										Switcher Duty Cycle
	Reman	0	0.25	0.10	0.35	14.0	0.72	51,000	3.98	n/a	20	$4,653	$6,515	50	17.50	5.00	n/a	213 Standard from 1997
	Reman	0+	0.10	0.00	0.10	11.8	0.26	51,000	2.57	0.21	20	$1,091	$1,091	50	5.00	0.00	10.52	BAT per 1033 Rule (2008)
	Upgrade ??	DFP																
	Pre T0	0+	0.35	0.10	0.45	11.8	0.26	51,000	6.55	0.21	20	$2,408	$3,095	50	22.50	5.00	10.52	Reman PreT0 to 0+
2	GP-38 (Pre-0)					17.4	0.44	50,000			20							Switcher Duty Cycle
	Replace	ULEL	1.60	0.00	1.60	2.8	0.10	40,000	13.39	0.31	10	$10,027	$10,027	50	80.00	669.5	15.6	New Tier 3 OR Diesels
	Rebuild	ULEL	0.12	0.00	0.12	2.8	0.10	40,000	0.01	0.01	10	$70,286	$70,286	50	6.00	0.5	0.5	Rebuild as T3 OR Diesels
	Upgrade	DPF	0.12	0.00	0.12	2.8	0.04	40,000	0.00	0.06	20	$8,069	$8,069	50	6.00	0.0	2.8	Not Currently Available/Prooven
	Upgrade	SCR																TBD, Does Not Esist
	Repower	4 OR																TBD, Does Not Esist

* Assumes a project life and a 4% rate of inflation that results in a Capital Recovery Factor; 20 years = 0.074 10 years = 0.123

* CMP is Carl Moyer Program weighted emissions in tons per year (= NOx + 20 * PM + ROG)

** Includes an estimate of the fuel penalty that will result on account of installation of aftertreatment devices(s).

Attachment 2 – An Initial Page-By-Page analysis of the Preliminary Draft of the Technical Options Document

- Appendix A – Detailed revisions to the ALECS section of the Draft
- Appendix B –Rail Industry Letters on Electrification to the Southern California Association of Governments from August 2007 and February 2008.

Attachment 2

Line by Line Comments on the Preliminary Draft of the Technical Options Document

[Note: Text *in italics* indicates direct quotes from the Preliminary Draft.]

1. ARB Statement on Per Unit Emission Calculations (P.2)

Staff generally calculated potential emissions reductions on a per unit basis.

Railroad Response

- The Next Draft should provide potential emission reductions on a per unit basis.
    - While ARB staff may have calculated emission reductions on a "per unit basis," the Preliminary Draft does not appear to provide this data. Instead, emission reductions are calculated based on an assumed locomotive fleet on a statewide and local geographic basis.

2. Railroad Comment on GHG Emissions

- The Next Draft should estimate changes in GHG emissions for all options.

3. ARB Statement on Cost-Effectiveness (P.2)

Cost-effectiveness was typically calculated by dividing total costs by the amount of NOx and PM pollutants reduced, over a specified range of years of use or useful life. The pollutants reduced were generally both diesel PM and NOx, but there are a few exceptions when information was not available. Staff tried to develop a simple cost-effectiveness range based on pollutants reduced in 2005 versus, in many cases, 2015 or 2020 to show the relative benefits of the various options.

Railroad Response

- All values shown for cost-effectiveness should be determined using a known, accepted and conventional methodology (i.e. the Carl Moyer Program).
- Furthermore, the Next Draft should provide the reader with estimates of all costs associated with each option, including …
    - changes in fuel consumption costs,
    - costs associated with increased re-fueling frequency,
    - changes in maintenance costs,
    - initial construction costs,

- estimates for time to rebuild/replacement (life expectancy),
- costs associated with the loss of asset utilization,
- additional infrastructure costs for fueling and urea injection,
- costs for down time (due to locomotive change out),
- research costs,
- development,
- training,
- service interruption, and
- interoperability of locomotives between railroads on a nationwide transportation system.

4. ARB Statement (Table ES-1 on P.3)

	SUBTOTAL	1.55	29.6	$1-5/lb	$630
6	A possible alternative to Option #2, replace up to 200 of the 400 older MHP locomotives with new MHP gen-set locomotives ($2 million/unit)	0.63	13.3	$2-4/lb (10-20 years)	$400

Railroad Response

- The reference to "#2" is incorrect. It should reference "#5".

5. ARB Statement (Table ES-3 on P.6)

30	Maglev from Ports of LA/LB to UP ICTF and proposed BNSF SCIG	0.033	0.66 **	$40-105/lb (15 years)	$300-$800
31	Linear Induction Motors (LIMs) Retrofit of Major Freight Rail Lines in the South Coast Air Basin	0.7 *	14.2 *	$30/lb (30 years)	$10,000
39	Electrification of Major Freight Rail Lines in the South Coast Air Basin	0.7 *	14.2 *	$40/lb (30 years)	$13,000

* Assumes 80 and 70 percent of PM and NOx locomotive emissions are reduced in the South Coast Air Basin.
** Estimated based on a factor of 20 of NOx to PM.
*** Insufficient data. [1] Most of these potential CARB diesel emission reductions would occur between state boundaries and major UP and BNSF refueling depots (e.g., Needles to Barstow, Truckee to Roseville, Yuma, AZ to Colton, CA, Las Vegas, NV to Yermo).

Railroad Response

- Regarding "***"in Table ES-3, ARB should explain why it uses "a factor of 20 of NOx to PM" for this option.

6. ARB Statement (Table ES-4 on P.7)

32	Build walls around the perimeter of railyards (Serve as barrier to diesel PM emissions)	*	*	*	$2.4/mile

Railroad Response

- ARB's discussion of the rail yard perimeter walls on page 132 states "[a]t this time, staff has been unable to identify any studies or data to suggest that walls can create a barrier or redirection effect on diesel PM emissions…." The descriptive text for Option 32 above should therefore be changed to say "(study potential for walls to serve as barriers to diesel PM emissions)"

7. ARB Statement (Table ES-4 on P.7)

33	Plant trees around the perimeter of railyards (To filter and create barrier to diesel PM emissions)	*	*	*	$.25/mile

Railroad Response

- Regarding Option 33: ARB has provided no evidence that this option is feasible. The Railroads suggest ARB change the parentheses to read "(study feasibility of trees to filter and create barrier to diesel PM emissions)."

8. Railroad Comment on Tables ES-5 and ES-6

- Tables ES-5 and ES-6 should include the cost-effectiveness estimates presented in the prior tables (ES 2 through ES 4 for example) to ensure consistency and to assist the reader in evaluating the options.

9. ARB Statement (P.8)

See Table ES-5

Railroad Response

- For Table ES-5, ARB should indicate how these options work in conjunction with each other.
- The measures regarding medium horsepower locomotives are confusing. Are they additive? It appears ARB is suggesting the Railroads first invest $250 million to repower medium horsepower locomotives and then, within a few years, retrofit the same locomotives with DPF and SCR?
- The Railroads provide further comments on the MHP options below.

10. ARB Statements (P.10)

In the first sentence, the report states:

> *The <u>proposed</u> locomotive options would provide the largest emissions and risk reductions within railyards, regionally, and statewide.* (Emphasis added)

Railroad Response

- The word "proposed" should be removed. As mentioned in our Group A comments, the Preliminary Draft provides an "initial technical assessment of various options" and does not assess the implementation or legal aspects of any option reviewed.

11. ARB Statements on Non-Locomotive Railyard Electrification (P.10)

Non-locomotive railyard electrification, if proven operationally feasible and cost-effective, could potentially nearly eliminate railyard cargo handling equipment emissions. Similarly, were the ALECS or Hood Technology proven to be operationally feasible and cost-effective, it could potentially reduce some stationary locomotive emissions at large locomotive classification and mechanical and servicing railyards.

Railroad Response

- Non-Locomotive railyard electrification, ALECS and Maglev were not identified as high priority options in Tables ES-5 or ES-6. As stated earlier, the Next Draft should not identify any options as "high priority." The three measures referenced on Page 10 are neither feasible nor cost effective and should be removed from this section.

- The first sentence shown above should be revised as follows: "Non-locomotive railyard electrification, if proven operationally feasible and cost-effective, could significantly reduce ~~potentially nearly eliminate~~ railyard cargo handling equipment emissions."

12. Railroad Suggested Changes to Table I-1 (P.12)

- Table I-1 should show, as the first row, total statewide emissions from all sources (in addition to the total mobile source emissions shown), to put the NOx and PM emissions from locomotives into better perspective.

13. ARB Statement on Cancer Risk (P.20)

Staff estimates that railyard mitigation plan diesel PM emission reductions will lower maximum individual cancer risks (MICR), in nearly all of the 18 railyards, from a range between 40 to 2,500 in a million to between 10 and 300 in a million by as early as 2015. Further, there would also be corresponding reductions in the population exposure to
greater than 10 in a million cancer risks.

Railroad Response

- Since the predicted health risk is discussed throughout the report, the Next Draft should include a discussion of what the risk numbers mean. Without further clarification in the Next Draft, the average reader may incorrectly assume that the predicted risk levels are actual risk levels rather than relative risk levels.

- The discussion of the predicted cancer risk at railyards is inadequate because it ignores the other off-site sources and their effects on neighbors. The Next Draft should include the other off-site sources in the risk discussion.

14. ARB Statement (P.37)

In this option, the 244 ULESLs would be retrofitted with emission control devices to reduce the emissions of NOx and PM.

Railroad Response

- This sentence should be revised to state "... of NOx and PM at the time of engine overhaul."
- Engine retrofits should optimally occur at the time of next engine overhaul in order to minimize the costs of locomotive down time.

15. ARB Statement (P.37):

The DPF and SCR retrofit emissions reductions would be in addition to the 244 ULESLs emissions reductions.

Railroad Response

- We suggest that this text be revised to state "...~~ULESLs~~ ULEL switch locomotive emission reductions in option 1 above."

16. Railroad Comment on Engine Overhaul Time for Gen-set Locomotives (P. 44)

- The text regarding time to overhaul for gen-set locomotives is inconsistent. In some locations it says 7 years (as it does in the first sentence of the 4th paragraph on page 44), some locations it's 7 to 10 years, and some locations it is 15 years (see the last paragraph on page 46). The Next Draft should use a consistent range.
- Preliminary calculations, based on useful life and data from the older technology single engine switch locomotives, indicated that rebuilds of gen-set switchers would need to occur every 7 to 10 years. However, initial data from gen-set operations indicates that rebuilds could occur in 10 to 15 years – or longer.
- No one knows for sure when gen-set engines will need to be rebuilt – it is too early to tell.

17. Railroad Comments on Medium Horsepower Locomotives (Pages 53 – 65)

- As indicated in our Group A comments, passenger locomotives represent over 48% of the MHP locomotives operating in California. The Next Draft should indicate this fact early and often. For example, the last paragraph on page 53, which discusses UP's and BNSF's MHP fleet characteristics, should also discuss the MHP fleets for the passenger railroads.
- The "Costs" sections for Options 5 (page 59) through 8 (page 65) in the Next Draft should provide a more complete discussion of actual costs, including, but not limited to, operating expenses, down time, research, maintenance, development, training, infrastructure, or service interruption. The Next Draft should also add a column showing total costs into Tables II-17 through II-20 (pages 58-63).

- The Preliminary Draft contains two Table II-18's (one on page 59 and one on page 61). The Next Draft should re-number these tables.
- The retrofit equipment proposed by ARB (DPF and SCR retrofits) in Option 7 is not yet available and too speculative to estimate cost.
  - The Railroads have invested over $4 million to develop a DPF for a MHP locomotive engine - and still do not have a working DPF. Initial test programs achieved only a 72% PM removal - compared to the 95% level which was initially expected. Furthermore, there are still considerable operating limitations with the technology.
  - SCR retrofits have not been demonstrated as feasible on a locomotive.
- Rather than focus on DPF technology for the MHP fleet, the Next Draft should instead include a discussion of the development of retrofit "oxycat" technology.
  - For example, UP and U.S. EPA developed a retrofit oxycat, which was installed on UP2368, which met the Tier 0 PM after overhaul.
- The Next Draft should include an assessment of the fuel penalty which results when retrofitting an uncontrolled locomotive with Tier 0 Plus retrofit kits. The Next Draft should assume a 3-5% fuel penalty. Furthermore, the Next Draft should indicate that any increase in fuel consumption will lead to an increase in GHG emissions.

18. ARB Statement (P.56)

An alternative to the first option is to replace up to 200 of the approximately 290 MHP freight locomotives with new gen-set MHP locomotives powered with four 700 horsepower nonroad engines, or about 2,800 horsepower. A four engine gen-set locomotive has not been U.S. EPA certified or ARB verified as of December 2008.

Railroad Response

- Regarding Option 6, the use of gen-set locomotives in a line haul application (i.e., high speed, long distance and high horsepower) is not a good idea because of the heaver use and shorter life of the higher speed engines.

19. ARB Statement (P.68)

This option would suggest the possibility of accelerating the introduction of new Tier 4 interstate line haul locomotives into California based on a similar approach employed with the 1998 Locomotive NOx Fleet Average Agreement for the South Coast Air Basin.

Railroad Response

- As indicated earlier, the Report should not discuss implementation issues and therefore the reference to a future fleet average should be removed.

- The sentence should be revised as follows: "This option would evaluate the use ~~suggest the possibility of accelerating the introduction~~ of new Tier 4 interstate line haul locomotives in~~to~~ California ~~based on a similar approach employed with the 1998 Locomotive NOx Fleet Average Agreement for the South Coast Air Basin~~."

20. ARB Statement (P.72)

RTG cranes have a horsepower range of 200 to 1,000 hp, with most being between around 300 to 1,000 hp.

Railroad Response

- The Next Draft should change this sentence as follows: "RTG cranes ~~have a horsepower~~ used in railroad intermodal yards typically range from 200-350 hp ~~of 200 to 1,000 hp, with most being between around 300 to 1,000 hp~~."

21. Railroad Comment on LNG Hostlers (P. 75)

- The Next Draft should indicate that, in many cases, the Railroads do not own or operate the hostlers at intermodal yards; and that while the Railroads have some leverage over the owners through the contract process, they are not the final decision makers for equipment upgrades and replacements.

22. ARB Statement (P.77)

One key aspect of the ARB CHE Regulation is its fuel neutrality. New yard trucks must meet the 2007+ on-road or Tier 4 off-road standards for PM and NOx regardless of fuel type.

Railroad Response

- These statements are incorrect. The CHE Regulation applies only to compression ignition engines (i.e. Diesel-fueled); and equipment fueled with non-diesel alternative fuels would not be subject to the CHE Regulation (they would be subject to the LSI Regulation). Also, if a 2007+ on-road or Tier 4 engine is not available, the owner/operator is permitted to purchase a vehicle with the highest available Tier off-road engine provided that a VDECS is installed within 1 year of purchase. The Next Draft should revise the two sentences above to accurately reflect ARB's adopted regulations.

23. ARB Statement (P.77)

...staff was not able to identify emission reductions that are surplus to the ARB CHE Regulation in 2015.

Railroad Response

- This sentence creates a false expectation that additional PM reductions are achieved by shifting to LNG hostlers and should be removed in the Next Draft.

- Appendix H shows using LNG yard hostlers in lieu of diesel fueled hostlers will provide no PM reductions benefit and will lead to an increase in NOx emissions. Therefore, there are no emission reductions, let alone reductions that are surplus to the CHE Regulation, as stated in the Preliminary Draft. The statement, as written now, could be misinterpreted and the reader could assume that there are emission reductions associated with the LNG hostler, but just not in excess of what would be achieved by the CHE Regulation.

24. ARB Statement (P.77)

. . .electric yard truck is capable of towing up to 30 tons, at a max. speed of 25 mph, and has a range of 30 miles when under full load.

Railroad Response

- The Next Draft should modify this statement to reflect that the electric hostlers are yet to be proven operationally or economically feasible, and that many aspects need to be evaluated before any conclusions can be made.
    - Concerns exist regarding the time needed to recharge the batteries, their ability to keep pace with operations, their durability, the likelihood of replacement of one diesel hostler with one electric, and the operating range. These issues must be evaluated before any cost effectiveness can be accurately calculated.

25. Railroad Comment on Option 13 (p. 80)

- The Next Draft should indicate that Energy Storage Systems on RTG cranes have not been demonstrated to be feasible or cost effective.

26. Railroad Comment on Option 14 (p.82)

- The Preliminary Draft's discussion of the use of WSGs is inaccurate. Installation of WSGs essentially requires the redesign and reconstruction of an entire yard, as the flow of goods and equipment completely changes.
- There are extensive structural foundations to be constructed in addition to the work for handling electrical power. Construction at existing facilities with continuous operations is extremely difficult. WSGs are not feasible at most railyards.
- Freight Railroads could use fewer WSGs than RTGs, however costs in addition to capital costs should be considered.
    - The costs in the document do not include the total disruption to customers for a year or more, and costs are not well explained. It is unclear if it includes foundation work. Track spacing is different for WSG vs. RTG facilities and must be done to be able to reduce hostler activities.

27. ARB Statement (P.82)

BNSF has installed WSG cranes at the BNSF Seattle International Gateway facility located at the Port of Seattle. BNSF has also proposed installing WSG cranes at other key intermodal facilities in Memphis and Kansas City.

Railroad Response

- Change to: "~~BNSF has~~ WSG cranes have been installed ~~WSG cranes~~ at the ~~BNSF Seattle International Gateway facility located at the~~ Port of Seattle and are proposed for other key intermodal facilities in Memphis, Kansas City, and Long Beach. ~~BNSF has also proposed installing WSG cranes at other key intermodal facilities in Memphis and Kansas City.~~

28. Railroad Comment on Table III-5 (p.84)

- This table should be renumbered III-7.
- Hobart had 1,340,000 lifts in 2005, and San Bernardino had 555,000 lifts in 2005
- The number of cranes needed seems to be tied to the 2005 lift count. The Next Draft should revise the estimates for the number of cranes to account for future growth in rail yard activities.
- The Next Draft should include a discussion of what is included and what assumptions were used in determining the cost of the electric infrastructure ($1.2 billion).

29. Railroad Comment on TRU Plug In Electrification (p.86)

- The Next Draft should indicate that TRU electrification requires that the container owner (not the railroad) retrofit their units to be compatible with the plug-in.
- The Next Draft should indicate that there is a time component in racking and de-racking the units when the truck or train is ready for the container, and as noted extra vehicle activity may be required to ferry containers around the yard to the racks.

30. ARB Statement (P.87)

Currently, there are no railyards in California with TRU plug-in electric power.

Railroad Response

- There are currently about 160 reefer plugs available at ICTF.

31. ARB Statement (P.87)

The necessary electrical infrastructure would likely be comparable to that currently planned for installation in the UP ICTF modernization plan.

Railroad Response

- This comment should be removed. The ICTF modernization electrical upgrades are facility wide and are being undertaken for reasons other than TRU plug-in and reefer racks.

32. ARB Statement (P.88)

The installation of reefer racks would necessitate installation of additional electrical infrastructure which could cost up to $500 million or more. However, nonlocomotive railyard electrification costs for eight intermodal railyards would cost an estimated $1.2 billion to be able to support the TRU plug-in electrification.

Railroad Response

- It is unclear how the costs for electrification were determined. Costs need to be clarified and explained.

33. Railroad Comment on Option 14. (Pages 82 and 84)

- There appears to be a disconnect (or missing assumptions) in the costs used for yard electrification in the WSG section and the TRU section. Table III-5 shows the costs to install WSG cranes and electrify the 8 intermodal yards as approximately $1.2 billion. The section states that the cost per crane is $4M-$8M/unit. Assuming an average cost of $6,000,000/crane and a total of 134 cranes, the equipment would cost $804,000,000. Subtracting the cost of the cranes themselves from to total provides a cost of $386,000,000 to electrify the 8 intermodal yards. This equated to a cost of roughly $48 million per yard for electrification.

34. Railroad Comment on ALECS (p.102).

The Railroads suggest that this section be revised as shown. See Appendix A which contains detailed proposed revisions.

35. ARB Statements (P.109)

In addition, staff assumed that all locomotives operating in California will either be equipped or retrofitted with idle reduction devices by 2012. Therefore, staff has not calculated potential additional emissions reductions or cost-effectiveness for this option.

Railroad Response

- This statement appears to be inconsistent with statements made in the preceding paragraph, where ARB calculates estimates emission reductions, estimates average cost, and determines that "cost-effectiveness on an annualized basis would be about $1 per pound or less of NOx and PM reduced."
- Given the inconsistencies between these paragraphs, and the comments shown above, the Railroads recommend that fuel savings and emissions reductions are very minimal/nil if there is strict adherence to the manual shutdown policy, and that if cost effectiveness is to be calculated, ARB needs to provide a more detailed review of all costs (capital and O&M) and the very limited emissions reductions benefits.

36. Railroad Comment on Hydrogen Fuel Cell Locomotive (p.111).

- The Next Draft should indicate that the technology discussed in Option 24 is neither feasible nor tested.

37. Railroad Comment on Regenerative Braking (p.112).

- The Next Draft should indicate that regenerative braking technology for locomotives is still under development and has not been proven feasible.

38. Railroad Comment on Ethanol-Fueled Locomotives (p.11).

- The Next Draft should indicate that an ethanol-fueled locomotive is not technologically feasible or proven.

39. ARB Statement (P.117):

<u>BNSF – Transcon – Southern – Chicago-Kansas-Belen-Barstow-POLA/POLB</u>

San Pedro	Barstow	Belen, NM	Wichita, KS	Chicago
2,200	2,100 (Refueling)	1,400 (Refueling)	730 (Refueling)	0 (Fueled)

Railroad Response

- The Next Draft should change "Wichita" to "Kansas City."
- The numbers and the information in the parentheses need further explanation in the Next Draft – it is not clear what they refer to.

40. Railroad Comment on Option 27 - Requiring CARB Diesel in Interstate Locomotives (p.115 - 120)

- The Next Draft needs to clarify how costs were calculated on pages 119 and 120.
    - The description on page 119 is confusing and it is difficult to understand ARB's methodology. Furthermore, the railroads can not verify the calculations.
    - There are a number of assumed values used in the calculations of emissions and emission reductions, including number of locomotives arriving in California per day, their average fuel consumption rate, their average emission rates, the distance traveled in California before refueling, etc. There are no references cited for these assumptions and there is no attempt to reconcile potential inconsistencies between assumptions. Several assumptions appear to be unrealistic.
- The Next Draft needs to include all of the costs associated with Option 27.
    - The Preliminary Draft's cost analysis for switching from EPA non-road to CARB Diesel fuel for arriving interstate trains acknowledges that it does not account for the actual retail fuel costs to the Railroads. Several other factors are also omitted, including…

        - The capital costs associated with the need for additional line haul locomotives for unit trains (at least 6, and potentially 12 or more units at $2M-$3M each).
        - The operating and maintenance costs for the additional line haul locomotives.
        - The capital, operating and maintenance costs for additional tank cars for the unit trains (at least 200, and potentially many more).
        - The capital and operating costs for new dedicated fuel storage and delivery systems at the out-of-state fueling depots.
        - The costs associated with increased railyard activity, train operations, maintenance of way, etc., both within California and at the out-of-state refueling depots.
        - The indirect costs associated with adding additional unit trains to congested track segments, and the resulting delays and operational effects.
        - Any additional costs associated with power moves and/or hauling empty tank cars back to California.
        - The state of California currently imposes a state sales tax on all diesel fuel UPRR purchases in the state. This tax is approximately $.155 per gallon. Fuel that is purchased in the state of California and then exported out via tank car would still be charged the sales tax. This would cost UPRR $1.25 to $2.5 million per month.
    - The number of gallons needed to satisfy Option 27 at some locations would require that all fuel issued would have to be CARB Diesel, not just amount needed for west bound trains.

- Under cost-effectiveness on page 120, the document estimates a 1.2 TPD reduction in NOx and PM, and the discussion on p. 119 gives an initial reduction estimate of 1.8 and 0.26 TPD of NOx and PM, offset by 0.5 and 0.2 TPD of unit train emissions. Please explain how these numbers were derived.

- The Next Draft should include additional fueling facilities for UP. In addition to Rawlins and El Paso, the Next draft should include the Pacific Northwest and Elko NV.

- The Next Draft should provide support for the statement on page 119 that "[h]eavy-duty diesel trucks operating at higher speeds and traveling similar levels of miles would produce similar levels of emissions." This statement is unsupported and is likely incorrect (unless the assumed truck fleet is for a year well into the future year). Furthermore, if heavy duty trucks are being proposed as an equal alternative to trains, then the Next Draft should include a discussion of the effect of increased truck traffic on congested routes between refineries and the state border.

- The emissions reduction analysis fails to note that in addition to the estimated costs of the measure, there would be an increase in fuel consumption of at least 6,000 gallons per day (unit train one-way only), and certainly much more if heavy duty trucks were to be used for fuel delivery of the CARB fuel. As more fuel is consumed, all emissions increase.

41. ARB Statement (P.120)

The federal test procedure (FTP) locomotive emission tests were all conducted at Southwest Research Institutes (SwRI's) facility in San Antonio, Texas at a cost of about $25,000 per locomotive.

Railroad Response

- The in-use testing can be done at other locations such as Boise, ID and at both EMD's and GE's facilities.
- 2008 billing data indicates that the cost is $30,000+ per locomotive.

42. Railroad Comment Regarding Electrification (p.122)

- ARB's discussion on the cost of electrification is inadequate. The Railroads have submitted comments to SCAG regarding electrification of rail lines, and we have attached them to these comments. See Appendix B.
- It would not be reasonable to assume that electrification could be completed before 2020, and therefore ARB's emission reductions should be based on 2020 emissions, not 2008 emissions.
- Reducing mainline emissions to zero is not realistic and is inconsistent with the SCRRA study.
- ARB's emission calculations must account for electricity generation sources. ARB states "Staff assumes emissions from electrical generation units in the South Coast Air Basin are controlled effectively through the use of natural gas fuel and selective catalytic reduction for NOx controls." This sentence does not mean there will be no increase in emissions.
- How was the figure of 460 miles of electrified track determined?
- Regarding the Alameda Corridor: the corridor was not constructed to accommodate electrified rail: there are no locations for transformers, no infrastructure for electric wires, etc. While the bridge clearances in the corridor are high enough to accommodate overhead catenary lines, this does not mean that the construction of the corridor will make "the transition to electrification somewhat easier." The clearances apply to any bridge or overpass being built over the rail system, and there is nothing special about the corridor in terms of its ability to be electrified.
- To our knowledge, SCAG is not currently studying electrification.
- Electric locomotives used in Europe are far smaller than those used in the US. ARB should not compare European locomotives to US freight locomotives.

- ARB indicates that in Europe, they saw a shift from train to truck because the electrification systems were incompatible from country to country. Why then would ARB proposed to make the South Coast rail system incompatible with the rest of the United States by requiring electrification?
- The SCRRA electrification study prepared an in-depth analysis of the impact that electrification would have on Metrolink and Amtrak. ARB does not appear to be requiring electrification for Amtrak and Metrolink. Is this accurate? Is this feasible?

43. Railroad Comment Regarding Maglev (p.126)

- The emissions for a Maglev scenario must include the added container-move by hostler at both the port and the railyard.
- The technology to move freight does not yet exist.
- The cost section must also include the additional land costs that will be needed to collect and load/unload containers onto the Maglev system on port property.
- The cost section must include the costs inherent in adding a second "lift" into the container transfer from the ship to the train. These costs include additional labor costs, operation and maintenance costs, insurance, etc.

44. Railroad Comment Regarding Perimeter Walls (p.132)

- Walls may not be technically feasible due to site-specific limitations or property ownership.
- The Preliminary Draft indicates that the potential emission reductions associated with the use of perimeter walls is uncertain; that statement is not correct. Rather, perimeter walls will not result in any reduction in emissions. Their purpose is to enhance dispersion; the Next Draft correctly indicates that for enhanced dispersion to occur, the emission sources need to be relatively near to the wall. In addition, the effective stack height of the sources (including plume rise) needs to be near to, or lower than, the wall height. Finally, the benefits of enhanced dispersion will be apparent only within 10-20 wall heights downwind of the wall; therefore, while perimeter walls may be effective, in some cases, in reducing exposures at locations close to rail yard boundaries, they will have little or no impact in terms of reducing population exposures.. Questions regarding the actual effects of enhanced dispersion also apply to the Report's discussion of tree planting.

45. Railroad Comment Regarding Tree Planting (p. 133 - 137)

- Trees may create sight line issues and may cause safety issues at areas such as road crossings.
- As is the case for perimeter sound walls, tree planting does not reduce emissions, although it may have the potential to reduce exposure due to enhanced dispersion and/or

capture of particulate matter. The benefits of enhanced dispersion are subject to the same limitations discussed above with respect to perimeter walls. The benefits of capture of pollutants are limited to DPM; no demonstration of the ability of trees to capture NOx emissions has been made. It is also unclear that the particle size and composition evaluated in the Cahill report is representative of the small particle size of DPM. Furthermore, there has been no assessment of the potential detriments (in terms of increased VOC emissions from the trees) relative to the potential benefits claimed.

- Higher efficiency HEPA filters require professional installation and system upgrades, and again are only effective when the central air is operational.

46. Railroad Comments on Truck Inspection Programs (P. 142)

- There may be an opportunity to conduct additional testing on drayage trucks, but rail has little or no control over the drayage trucks. There are already programs in place for locomotive testing.

47. Railroad Comments on Movement of Railyard Sources (P. 144)

- Agree that technical feasibility is limited by specific operational constraints.
- Page 143 describes the 90% reduction with distances of 1500 meters, but the Figure on Page 144 shows 90% reduction at 1500 feet. The description using 1500 meters seems incorrect.

48. Railroad Comment Regarding Appendix A – Railyards

- A date should be entered in the title of the chart on page 149.
- A date should be entered in the title of the chart on the top of page 150.
- Data is missing for BNSF Sheila on page 151.
- On page 156, the "New NOx Standards…" for the Uncontrolled categories are incorrect.
- On page 157, the "New PM Standards…" for the Uncontrolled category are incorrect.
- On page 157, ARB should insert a statement noting the new federal fuel requirements which will bring fuel sulfur content from 500ppm to 15 ppm in 2012.
- Page 161 should be changed as follows: "In addition, it is critical that aftertreatment not adversely affect engine exhaust flows and combustion efficiencies, and can fit into the limited areas available within a locomotive carbody space. The latter is critical due to considerations of locomotive~~s~~ serviceability and reliability; and such that they are ~~being~~ able to travel through tunnels across the nation."

- Page 161 should be changed as follows: "Diesel oxidation catalysts (DOCs) use a catalyst material and oxygen in the ~~air~~ exhaust to trigger…"
- On page 161, oxidation catalysts have been shown to achieve ROG reductions much higher than 30%. This value should be corrected.
- The Railroads are confused by ARB's statement on page 161 that "A DOC can reduce large particles to enhance the efficiency of a DPF and to reduce carbon build up on a DPF's walls." Please provide further explanation.
- The first full paragraph on the top of page 162 is confusing and should be rewritten for clarity.
- In the first paragraph of section 2 on page 162, the Railroads do not understand where the CO2 could come from. Furthermore, catalysts can be both metallic and ceramic. Finally, how is the flue gas "absorbed" into the catalyst?
- Page 163 should be revised as follows:
  *After five years of research and bench testing, the UP and BNSF switch locomotives were retrofitted with very large DPFs (*two on each locomotive, each *about piano size – 1,100 pounds) in front of the cabs of UPY 1378 and BNSF 3703. Baseline emission testing indicates that these switchers can provide up to an 80 percent reduction in particulate matter and 30 percent reduction in hydrocarbon emissions.*

  UPY 1378 is a Tier 0 EMD MP15DC locomotive and *was released into demonstration service in December 2006 to the UP Oakland yard, and then recently transferred to the UP Roseville yard. UPY 1378 has been operating over the past year with only minor mechanical and aftertreatment adjustments. BNSF 3703 was retrofitted with the* same *DPF* technology *in late 2006, but for nearly two* years~~d~~ remained at ~~*had not been able to leave*~~ *the Southwest Research Institute (SwRI) facility in San Antonio, Texas due to ongoing technical challenges in* improving ~~*getting*~~ *the DPF system* efficiency. ~~*to work properly with the locomotive.*~~ *In* April *2008, BNSF 3703 arrived in Southern California for demonstration testing.*

  An important consideration with DPF retrofits on switch locomotives is the recent advances in switch locomotive technology (i.e., gen-set and electric hybrid) since the CEP program was initiated over 7 years ago. Gen-set and electric hybrid switch locomotives can provide up to a 90 percent reduction in both particulate matter and NOx emissions without aftertreatment. *These switch locomotives also significantly reduce diesel fuel consumption by 20 to 25 percent.*
- In the last line on page 163, change "EMD 710" to "EMD 16-710-G3B".
- On page 163, revise as follows: *"UP 2368 baseline emission testing indicated that the DOC could reduce* DPM ~~*larger particles (e.g., soluble organic fraction) in particulate matter*~~ *by up to 50 percent."*

- On page 163, ARB states: *"The most recent failure resulted in the breakdown of catalysts that broke away from the DOC and flew up into the turbocharger."* This is not true - the catalyst panels started to break apart.

- On page 163, revise as follows: *"Generally, these three DOC related failures have been attributed to ~~locomotive vibration and~~ the large two-stroke medium speed EMD engine with extreme. ~~and intermittent~~ exhaust pulsations."*

- On page 163, revise as follows: *"The SwRI~~I~~ bench tests were conducted on an EMD 710 – 12 cylinder engine, which is the same engine family commonly used on pre-2000 freight line haul locomotives (~75 percent), passenger locomotives (most in California), and some marine vessels. The EMD* 3000 hp 12-*710* G3 *engine was retrofitted with the compact SCR device for performance and emission testing. During the performance testing, significant issues occurred with the SCR system's ability to dose the urea properly. Part of this urea dosing imbalance was caused by the un-uniform engine exhaust flows* within the turbocharger outlet *of the EMD 710 engine and the challenge for the compact SCR system to be able to adjust urea dosing precisely ~~to the engine exhaust fluctuations~~.* The poor mixing *~~This imbalance in the dosing of the urea~~ resulted in large amounts of ammonia slip ~~and dried ammonia crystals deposited throughout the engine~~. EF&EE is currently working to redesign the compact SCR and urea dosing system to try to address these issues. SwRI completed the report for this research effort in March 2008."*

49. Railroad Comment Regarding Appendix E – Switch Locomotives

- The railroads would like ARB to determine the correct conversion factor for all classes of locomotives. ARB uses a correction factor of 20.8 bhp-hr/gal for all classes, however SwRI indicates that this value is incorrect. SwRI suggest using 18.1 bhp-hr/gal for linehaul engines and 14.8 bhp-hr/gal for switch locomotives. ARB should cite the source of any conversion factors used in the Next Draft.

- (P. 173) This page shows the calculations supporting Option 2. ARB assumes that Tier 3 nonroad engines are 20 percent more fuel efficient than existing Tier 0 switch locomotives. ARB should provide the data to support this assumption.

- ARB assumes that there will be no change in the fuel efficiency when DPF and SCR are applied. ARB should cite the supporting data for this assumption.

- (P. 174) This page shows the calculations supporting Option 3. ARB assumes that Tier 3 nonroad engines are 20 percent more fuel efficient than existing Tier 0 switch locomotives. ARB further assumes that Tier 4 nonroad gen-set engines will be just as fuel efficient as Tier 3 nonroad engines. ARB should cite the sources for these assumptions.

50. Railroad Comment Regarding Appendix F – MHP

- ARB has not assumed a fuel penalty in going from uncontrolled to Tier 0 Plus. The Next Draft should assume a 3-5% fuel penalty and should contain a discussion about how this increase will lead to an increase in GHG emissions.

51. Railroad Comment Regarding Appendix F – MHP

- The Next Draft should include an option for the railroads to replace MHP with Tier 3 linehaul locomotives

52. Railroad Comment Regarding Appendix I – TRU

- In the TRU appendix (p. 200), a cost of $500 million is used for the total to electrify all 8 intermodal yards. This equates to roughly $62.5 million per yard for electrification.

53. Railroad Comment Regarding Appendix K – ALECS

- The calculations show an estimated emission reduction of 1 ton per year. But this value is for current operations. The Next Draft should indicate what will happen in 5 or 10 years when there are Tier 4s and Gen-sets in the fleet?

54. Railroad comments on Appendix N - Maglev

- The Next Draft should revise its calculation methodology for determining the emission reductions from Maglev. In order to determine the emission reductions, ARB needs to determine how containers will be moved from the ship to the train (and vice-versa) and every transfer that will occur along the way. For example:
    - How many containers will be moved by the Maglev system?
    - From which port terminal will the containers come from?
    - How will the containers be moved from the port terminal to the Maglev loading area? What emissions will come from this vehicle?
    - If containers needed to be staged at the Maglev loading area, how will the containers be moved from the staging area to the Maglev system? What emissions will come from this vehicle/equipment?
    - Once the container arrives at the railyard, how will the container be removed from the Maglev system? What emissions will come from this vehicle/equipment?
    - How will the container be moved to be loaded on a train? What emissions will come from this vehicle?
    - How will the container be loaded to the train? What emissions will come from this vehicle/equipment?
- What is the assumed emission level of the truck fleet and hostler fleet that will be replaced by the Maglev system?

Appendix A

A. Advanced Locomotive Emission Control System (ALECS)

1. Background

~~The~~[1]**In concept, the**[2] Advanced Locomotive Emission Control System (ALECS), otherwise known as the "hood project", is a set of stationary emissions control equipment connected to an articulated bonnet. The bonnet is designed to capture or extract locomotive exhaust air pollutants and deliver the pollutants to ~~the~~[3]**a**[4] ground-based emission control system via ducting. The bonnet hood ~~remains~~[5]**would remain**[6] attached via ducting to the stationary system, but ~~has~~[7]**would have**[8] the flexibility to move with the locomotive as it moves slowly for short distances. The **preliminary design discussions revealed that the** [9]bonnet movements ~~are~~[10]**would be**[11] limited by the length of the full system ducting, or about 400 to 1,200 meters **(meters or feet?)** [12]in length, depending on the system configuration.

The future full scale deployment concept of ALECS was designed (for costing purposes) to be a versatile system that can be arranged to accommodate many railyard configurations using common components. These components ~~can~~[13]**could**[14] be used to tailor a system to an area of the railyard with varying numbers of parallel tracks of different lengths. For the economic analysis, staff assumed the ALECS would cover an estimated 1,200 feet length of track. The track ~~can~~[15]**could**[16] be three 400 foot sections side-by-[17] side, two 600 foot sections side-by-side, or one continuous track at 1,200 feet **(meters or feet?)** [18]in length, servicing up to 12 locomotives. (TIAX Report April 2007)

The ALECS stationary ~~emission control~~[19]**emissions treatment system (ETS)**[20] equipment ~~comprises~~[21]**is comprised of**[22] a sodium hydroxide wash to remove sulfur dioxide (SO2), a triple cloud chamber scrubber for PM removal, and a Selective Catalytic Reduction (SCR) reactor to reduce oxides of nitrogen (NOx). The ~~ALECS~~[23]**ETS**[24] is designed to treat exhaust flows between 2,000 and 12,000 standard cubic feet per minute (scfm). The former is approximately the exhaust flow from a locomotive at idle, while the latter is approximately the exhaust flow from a line-haul locomotive at throttle Notch 8 (i.e., full power).

The most likely application of ALECS is in areas of the railyard where the utilization rate **(emissions capture)** [25]can be maximized. This potentially would include railyard service, maintenance, and refueling locations (See Figures 1and 2 in Appendix K).

2. Analysis of Option 21 – Advanced Locomotive Emissions Control Systems (ALECS)

Technical Feasibility

The ETS portion of [26]ALECS ~~employs~~[27]**would employ**[28] stationary emission control elements (e.g., scrubbers, SCR, etc.) that have been tested extensively and are commercially available for use with stationary sources. The UP Roseville Railyard preliminary locomotive testing demonstrated ALECS has potential control efficiencies of up to 90 percent or more for NOx and PM and other pollutants.[29] **The 90% estimated emission reductions for NOx and PM attributed to ALECS do not reflect the emissions associated with the substantial energy consumption associated with operation of the control system: an estimated 328 kw continuous electrical demand, and 2.6 MMbtu/hr for a natural gas burner for each 12,000 scfm system. (TIAX Report, p., 4-5)**[30]

The **emissions capture system (ECS) portion of** [31]ALECS ~~system~~[32] was initially tested on a limited basis, with a small number of locomotives on an isolated and separate track, as part of a pilot program at the UP Roseville Railyard in the summer of 2007. ~~The UP Roseville Railyard preliminary locomotive testing demonstrated ALECS has potential control efficiencies of up to 90 percent or more for NOx and PM and other pollutants.~~[33] **The ECS has not yet been tested on a large scale to demonstrate ability to effectively capture and convey locomotive emissions to the ETS over a period of time (i.e. – 6 months) sufficient to demonstrate its durability and effectiveness.** [34]

ALECS has not been subject to full-scale railyard demonstration testing. Full-scale railyard demonstration testing is needed to determine the potential utilization rates and emissions reductions within actual railyard operations. Another reason for the demonstration testing is to determine what effects, if any, the ALECS system would have on the timeliness and effectiveness of railyard operations (i.e., moving locomotives in and out of the railyard). A full-scale demonstration **of the ECS** [35]is also needed to assess ALECS multiple bonnet system options to determine which can best be utilized between the locomotives and the stationary control equipment. ~~ALECS is scheduled to begin a fullscale~~[36]**A full scale**[37] demonstration project ~~at~~[38]**is contemplated for**[39] the UP Roseville railyard ~~in early 2009, and conclude in mid-2010.~~[40]**, but has not been scheduled.**[41]

The ALECS demonstration testing will primarily focus on the potential to reduce railyard service and maintenance diesel PM emissions. Service and maintenance areas are where the greatest numbers of locomotives operate in idle or are stationary for diagnostic testing purposes for the greatest periods of time. The ALECS bonnet system ~~can~~[42]**is designed to**[43] move ~~very short distances~~ [44]with rolling locomotives, but ~~is~~[45]**would be**[46] limited to a total system length of about 1,200 feet or 1/5 of a mile or so. ALECS is a stationary system that is not designed to move on rail tracks alongside locomotives. This is a system limitation in railyards, as locomotives move throughout different parts of **railyards that are** [47]usually 2 ~~mile~~[48]**miles**[49] long or longer ~~railyard tracks~~[50]. As a result, ALECS needs to be installed in areas of railyards where the greatest number of locomotives congregate, and are generally stationary, while locomotive engines are operational.

Potential Emission Reductions

As mentioned above, ALECS can reduce stationary locomotive emissions by up to 90 percent or greater, based on UP Roseville Railyard pilot program testing. ~~In 2005, the total locomotive service and testing diesel PM emissions for 18 major railyards (where railyard HRAs were performed) were estimated to be about 18 tons per year.~~[51] The potential emissions reductions that may result from the use of ALECS will vary by individual railyard **and location within the yard**[52]. ALECS potential ~~railyard~~ [53]emission reductions will be highly dependent on the specific operations conducted ~~within a railyard, especially areas~~[54]**at the individual location and the emissions available for capture and treatment (i.e. -**[55] where locomotives are idling or maintenance personnel perform engine diagnostics for extended periods of times**)**[56].

The [57]ARB HRA Study 2004, based on 2000 year baseline emissions[58] **at the** [59]UP Roseville Railyard **found that** [60]service related diesel PM emissions [61]accounted for about one-third, or about 6 tons per year, of the total railyard ~~service related diesel PM emissions~~ [62]~~(~~[63]~~ARB HRA Study 2004, based on 2000 year baseline emissions~~[64]~~). In the UP Roseville~~

~~Railyard, service and maintenance areas that contributed largely to the 6 tons per year of diesel PM emissions are divided into sub-areas:~~[65]**Those emissions emanated from various sub-areas such as**[66] 1) **the**[67] "ready tracks" area, 2) **the** [68]east side of the "maintenance facility" area, 3) west side of the "maintenance facility" area, 4) "modsearch building" area, and 5) "service tracks" area or inspection pit area **.** [69](See ~~Figure~~[70]**Figures**[71] 1 and 2 in Appendix K).

Though staff assumed ~~ALECS was~~[72]**ECS would serve a track of up to**[73] 1,200 feet in length, ~~it~~[74]**the ETS**[75] is a stationary system that is ~~generally~~ [76]limited to operate in one specific area of a railyard. For example, one stationary ALECS bonnet system would not be able to cover the entire UP Roseville railyard, which is about 7 miles in length and about ½ mile wide. As a result, a separate ALECS unit would be needed for each area as shown in Figure 1 and Figure 2. ~~For example~~[77] **Thus**[78], one unit would be needed for the east side of the maintenance facility, one unit for west side, etc.

The UP Roseville railyard ~~ALECS~~[79]**ECS**[80] demonstration testing ~~in 2009-2010~~ [81]is planned on the west side of the maintenance shop (See Appendix K). At that location, locomotives are diagnostically tested after mechanical repairs, and as part of the diagnostic testing, the locomotives operate in different notch (power) settings from notch 5 through notch 8. Locomotives have eight power or notch settings. In idle or Notch 1, locomotives consume about 5 gallons per hour of diesel fuel. In ~~comparision~~[82]**comparison**[83], in Notch 8 locomotives can consume up to 200 gallons per hour. Therefore, which power setting a locomotive operates in can have a significant effect on locomotive railyard emissions and the potential emissions ~~reductions that~~ [84]could be ~~provided by~~[85]**available for**[86] ALECS **to capture and treat**[87].

The UP Roseville railyard's west side of the maintenance track is approximately 600 feet in length. In 2000, the diesel PM emissions at the UP Roseville railyard west side maintenance track area ~~was~~[88]**were**[89] estimated to be about 0.81 tons per year. Of that total (0.81 tons per year), pre- and post-test emissions accounted for about 0.53 tons per year, locomotive idling about 0.23 tons per year, and locomotive movements about 0.05 tons per year. (See figure 2 in Appendix K). Staff has assumed the diesel PM emissions are as high as 1 ~~tons~~[90]**ton**[91] per year at the west side of the maintenance track. ~~UP Roseville and BNSF Barstow are two of~~

~~the largest classification yards on the west coast. These two yards combined accounted for about two-thirds of the 18 major railyards service and maintenance diesel PM emissions in 2005, or about 12 of the 18 tons per year. Based on these data, and emissions in individual subareas of these railyards, for one ALECS at one area of a major classification railyard in California, the potential maximum is about 1 ton per year or less of diesel PM emissions reductions.~~[92]

Costs

The initial capital costs of a single ALECS unit, with an estimated 12 bonnet system, ~~is~~[93]**are**[94] about $8.7 million. Annual operational costs for an ALECS unit ~~is~~[95]**are**[96] estimated to be about $900,000. As a result, the total capital and operational costs of a single ALECS unit for a 20 year period is about $25 million. These capital costs include the purchase cost, 20 years of operational and maintenance costs, and on average $64,000 every five years for the catalyst replacement. (Source: TIAX Report).

Cost-Effectiveness

Preliminary cost-effectiveness data was developed in the TIAX Report, based on the experience with the ALECS pilot program in 2007. TIAX estimated ALECS would be in full operation 96 percent of the time, or 23 out of 24 hours per day. This may be an unrealistic expectation for use of ALECS in California's railyards. The railyards can and do operate up to 24 hours per day. However, **staff believes that** [97]most locomotive intermodal and classification railyard peak activities occur between 6 am and 6 pm. There are also numerous hours each day from 6 am to 6 pm, where there is significantly less activity occurring than during key peak periods.

TIAX included NOx, HC, and PM in the cost-effectiveness calculation. Oxides of sulfur (SOx) emissions reduced were not included in the cost-effectiveness calculation. TIAX also weighted the PM emissions reduced by a factor of 20, based on the Carl Moyer Incentive Program guidelines. This weighting was used in calculating cost-effectiveness because of the toxicity level of PM. According to TIAX, and based on the assumptions above, TIAX estimated the cost-effectiveness for ALECS to range between $3.60 and $9 per pound of weighted pollutant reduced. This range of cost-effectiveness was largely dependent on the mode of locomotive operations (i.e., power setting), a Tier 0 versus Tier 2 locomotive, and the 96 percent utilization rate. (TIAX April 2007)

The UP Roseville Railyard ~~ALECS~~[98]**ECS**[99] full-scale demonstration project ~~is~~[100]**has not yet been**[101] scheduled ~~to begin in early 2009.~~[102]**.**[103] The west side of the UP Roseville Railyard maintenance facility was chosen as the area of the railyard ~~to demonstrate ALECS.~~[104]**for the demonstration**[105] At this location in the railyard, the estimated diesel PM emissions are about 0.80 tons per year (See figure 1 and 2 in Appendix K).

In this cost-effectiveness calculation, staff assumed that the total emissions reductions for the west side of the maintenance facility area are about 21 tons per year (i.e., 1.0 and 20 - PM and NOx tons per year, respectively). Based on these assumptions, staff estimates the ALECS cost-effectiveness is about $30 per pound of PM and NOx reduced for this scenario. Detailed calculations and scenarios are described in Appendix K. **Note that service idling and movement DPM emissions at the Roseville Rail Yard declined from the 6 ton per year level cited in the report (from the ARB 2004 HRA) to 2.6 tons per year in 2007, as shown in the June 3, 2008 inventory update submitted by Union Pacific to the Placer County APCD. Similarly, shop idling emissions are estimated to be 0.6 tons per year in 2007, and load testing is now performed at a variety of locations through the rail yard, rather than being concentrated near the maintenance shop, as was the case in 1999-2000. These changes in operating practices and activity levels will make it more difficult to apply ALECS to the Roseville yard, and will adversely affect cost-effectiveness.**[106]

Appendix B

THE CALIFORNIA RAILROAD INDUSTRY

August 24, 2007

Mr. Mark Pisano
Executive Director
Southern California Association of Governments
818 W. Seventh Street, 12th Floor
Los Angeles, CA 90017

Re: Freight Railroad Industry Questions Concerning SCAG's Electrification Project

Dear Mr. Pisano:

On behalf of the Association of American Railroads and the Class I freight railroads operating in California (the Railroads), this letter highlights some of the main issues and questions we have about SCAG's Proposed Freight Rail Emission Reduction Strategy to Meet 2014 Air Quality Standards for PM2.5 (also referred to as the "SCAG Strategy" or the "Electrification Project"). In order for the Railroads to provide meaningful comments on your proposal, we would like to better understand the following elements that we outline below.

Feasibility of Creating an Electrified Freight and Passenger Railway System by 2014

The Railroads have indicated on several occasions that it is extremely unlikely that the emissions reductions associated with SCAG's Strategy can be achieved by 2014. The 1992 Report on the Southern California Accelerated Rail Electrification Program (the Electrification Report) prepared for the Southern California Regional Rail Authority (SCRRA) indicated that the time required for full implementation (i.e. conceptual design, preliminary engineering, environmental design, request for proposal/bid/award process, construction, functional testing and startup phase) would range between 11 and 14 years. As you will recall, the 1992 program only pertained to the major or mainline freight corridors. Given that the EIR process takes significantly longer now than in it did in 1992, the 11-14 year schedule is likely over-optimistic. Furthermore, the Electrification Report did not contemplate the construction of a significant number of grade crossings or the expansion of the rail system, as SCAG has proposed under its Strategy. After careful review of the 1992 report, the Railroads cannot understand how SCAG can achieve its objective by 2014. We have a number of specific questions and requests for information relating to feasibility. Timely answers will help us to provide constructive and thoughtful comments on the SCAG Strategy.

1. Please provide data supporting the feasibility of designing, constructing and operating an electrified freight and passenger railway system by 2014. It would be helpful if this information included:

a. A specific description of the project.
b. A detailed description of the routes which would be electrified.
c. Whether or not the railyards would be electrified.
    i. If so, a description of how freight would be moved in the electrified yards.
d. An estimate of the time necessary to complete the required environmental documents and permitting process.
e. The level of rail service interruption (both passenger and freight) which will occur during the proposed construction schedule.

Energy Issues

SCAG staff is proposing that the Railroads utilize electric power rather than diesel fuel. It is necessary, therefore, that stakeholders understand the SCAG staff's assumptions about the near- and long-term electricity demand and pricing conditions in order to determine the consequences of moving to an electric system.

2. Please provide the assumptions that the SCAG staff has used for analysis of the electrical requirements for the Strategy and whether sufficient capacity exists in 2014 and beyond. It would be helpful if this information included SCAG staff's assessment of:
    a. The current and future capacity and energy requirements to support electrified railways (both in and megawatts and megawatt hours) to accommodate future rail traffic growth in 2014 and beyond.
    b. Whether capacity exists within the SCAG region to accommodate the Strategy's requirements both now and in the future.
    c. Identified acceptable locations for additional transformers, substations, and power lines.
    d. Expected electricity prices for the SCAG region in both the near- and long-term time frame.

Funding Issues

The Railroads have seen only a limited amount of information pertaining to funding issues. In order to comment productively on SCAG's strategy, it would be helpful for all stakeholders, including the Railroads, to understand SCAG's funding plan for the rail capacity improvements, the grade separations, the electrification program, and the fleet retrofit program.

3. Please provide a more detailed funding plan for the planned grade separations.
    a. Please identify commitment levels from each affected party.
    b. Please identify whether the capacity improvements, rail electrification program, or the fleet retrofit program are dependent on completing some or all of the grade separation projects?

4. What level of funding commitment is necessary for inclusion in the Regional Transportation Plan (RTP)?
    a. If a reliable funding program is not identified, will the Strategy be included in the RTP and the Air Quality Management Plan (AQMP)?

Calculation of Emission Reductions

While the Railroads have had a couple of conversations with SCAG staff about how they have calculated emissions reductions, the SCAG staff has yet to provide a detailed analysis of the expected emission reductions associated with the proposed Strategy. To assist in compiling the information we are asking for, we include the following requests:

5. Please provide staff's methodology for estimating emission reductions from the Electrification Strategy.
    a. Does SCAG staff assume that railyards and "local" tracks are electrified?
    b. Does SCAG staff assume, as indicated in the 1992 Electrification Report, that intermodal through trains would continue to operate on diesel technology?
    c. How does the methodology accommodate for modal shift during the construction phase (e.g. if rail capacity declines over a multi-year period due to construction, goods movement will shift from rail to truck systems)?
    d. Please provide staff's estimate of emissions associated with the incremental increase in electricity generation.
    e. Has SCAG staff analyzed the potential for negative environmental consequences caused by increased costs due to electrification (e.g. increased emissions from a possible modal shift from trains to trucks)?
6. Please provide detailed estimates of forecasted emission reductions for each criteria pollutant from the SCAG Strategy for the years 2014, 2020, and 2023.

Discussion of Grade Separations

The railroads are interested in the potential benefits SCAG envisions from grade crossing separations. More specifically, the railroads are interested in the emissions reductions SCAG staff believes would be achieved from grade separations, which presumably would be attributable to reduced motor vehicle idling.

Discussion of "Dual Mode" Locomotives

The Railroads have indicated that it is not possible to operate an all electric railroad system in the SCAG region. Some have mentioned the possibility of using "dual-mode" locomotives to solve this problem. Dual-mode locomotives have the ability to operate solely on electricity when under the wires and solely on diesel once they are outside the electric system. Each locomotive contains the components of a diesel/electric locomotive (e.g. diesel engine, alternator, cooling system, fuel, fuel tank, etc.) and the components for an electric system (e.g. transformer, pantograph, and switch gear).

Unfortunately, high horsepower dual-mode locomotives do not exist. While it is true that some passenger systems have operated a few of these types of locomotives, these are only 4-axle low horsepower (1000 to 2000 hp) units. A few specialized mining locomotives also utilize dual-mode technology, however, high horsepower (4000+) dual-mode freight locomotives have never been produced – and for good reason.

First, any dual-mode U.S. freight locomotive would have to be developed "from scratch" and would be very expensive. Second, a dual-mode freight locomotive would suffer a very high level of inefficiency as a result of hauling around "the other" propulsion technology. That is, when the dual-mode locomotive operates in non-electrified territory, the locomotive has to haul the dead weight of the step-down transformer, the pantograph, the switch gear, etc. Conversely, when the dual-mode locomotive operates in electrified territory, the diesel engine, alternator, cooling system, fuel and fuel tank all "go along for the ride." There are obviously some significant weight trade offs and fuel/energy inefficiencies.

Third, a dual-mode U.S. freight unit would likely have to be 4400-6000 diesel horsepower and 8000 electric horsepower, would undoubtedly require an 8-axle/8-motor design, and would need to be much longer than today's Tier 2 units, in order to accommodate the diesel engine and transformer onboard. To put things in perspective, a transformer capable of 6000 HP or more would itself be very large (roughly 8 feet long x 8 feet high x 6 feet wide) and there is insufficient space in today's locomotives to accommodate this item alone (unless the operator cab was eliminated). Even without the operator cab, such a locomotive on 6-axles would be weight-prohibitive; 8-axles would be needed.

For these reasons, a dual-mode freight locomotive does not resolve the significant operational difficulties which arise when considering an electrified system in the SCAG region. If such locomotives are believed to be a possible compliance option under the SCAG program, please provide the following information:

7. Please provide all materials SCAG staff has pertaining to dual-mode locomotives.
    a. What independent entity, if any, has determined that such a locomotive would be available and cost-effective by 2014?
    b. What assumptions has the staff made about the relative number of locomotive hours in diesel mode versus in all-electric mode for operations in the L.A. Basin?

Feasibility of Operating a Fleet of Tier 3 Locomotives by 2014 and a Fleet of Tier 4 Locomotives by 2020

As an alternative to electrification, SCAG staff proposes that the fleet of locomotives operating in the SCAG region be comprised of an unspecified percentage of Tier 3 locomotives by 2014 and that the entire fleet of locomotives operating in the SCAG region be converted to Tier 4 locomotives by 2020. Recognizing that EPA has not yet issued final Tier 3 and 4 standards, SCAG staff has not shown how its proposal could be achieved under any conceivable standards. Is SCAG assuming that locomotives would be changed at the borders of the SCAG region? No other mode of transportation is subject to such a disruption to its operating practices. Cost aside, such a scheme may well seriously impact the Railroads' ability to provide customers with adequate service. Were this to happen, the result could be diversion to other less efficient modes, causing an increase in emissions. We would appreciate the following information:

8. What are SCAG's assumptions about the number of Tier 3 and Tier 4 locomotives that the Railroads would have to acquire, and over what timeframe, in order to comply with this element of SCAG's Strategy?

We hope that the questions above are helpful in framing the types of issues we would like to discuss during our upcoming meeting; we have also summarized them in the enclosure. The Railroads look forward to continuing to work closely with SCAG staff on this issue, and we look forward to meeting with you and your staff in the near future. If you have any questions or concerns, please call me at 415-215-4213 or Peter Okurowski at 925-339-3500.

Sincerely,

Kirk Marckwald
Principal, California Environmental Associates
On behalf of the California Railroad Industry

THE CALIFORNIA RAILROAD INDUSTRY

February 15, 2008

Gary Ovitt
Southern California Association of Governments
818 W. Seventh Street, 12th Floor
Los Angeles, CA 90017

Re: Freight Railroad Comments Electrification

Dear Supervisor Ovitt:

The Association of American Railroads, the Class I freight railroads operating in California, and Pacific Harbor Lines (the Railroads) appreciate the opportunity to comment on the Draft Rail Business Plan provided to the Railroads in mid-September, 2007, and the strategic plan Freight Rail Electrification Report of Findings (Appendix C) from the Goods Movement Report in the 2008 Draft RTP. This letter briefly highlights some of the high level issues regarding the electrification of freight rail in Southern California.

Overview

Over the past 15 years, SCAG has considered electrification of passenger and freight rail as a possible measure to reduce criteria pollutant emissions in the SCAG region. SCAG and the Southern California Regional Rail Authority (SCRRA) have studied the feasibility of electrifying the southern California passenger and freight lines since 1992. These studies concluded electrification is not a practical or comprehensive emission reduction strategy for locomotives. SCAG has not included rail electrification as part of the Draft RTP and instead has included a "Report of Findings" in the strategic plan section of the Draft RTP.

The most recent SCAG proposals, and all previous studies of electrification in southern California, raise insurmountable operational and cost-effectiveness issues that must be thoroughly considered in any public policy discussion. While the concepts may seem simple at first, the unique complexity of railroad operations in southern California and the large distances considered for electrification make the analysis of electrification far more complex than one might expect. There is a special conundrum presented by electrification of a linear system; to get maximum benefits and avoid doubling-up on different kinds of locomotive investments, the electrified system has to be so massive that the costs to achieve relatively few tons of emissions reductions become astronomical.

Simply put, electrification of the Southern California freight and passenger lines will lead to increased inefficiencies (fewer containers could be moved on the system), tremendous costs (potentially $10B-$50B), few emission reductions, increased visual impacts from new substations and power lines, and decreased system reliability. Main items to be considered are briefly presented below.

As an aside, it is important to note the differences between electrified passenger and freight electric railroad systems in other countries and the diesel-propelled North American heavy haul freight system. For example, passenger and freight trains in Europe typically only use one electric locomotive and are short, light weight and powered for speed. (The average freight train in Germany, for example, has 7,000-to-9,000 electric locomotive horsepower hauling about 600 tons. The average freight train in the western US has 9,000 diesel horsepower hauling 6,000 tons.) In comparison, any freight rail electrification installation in the US would have significantly more robustness and power rating. This would increase the capital investment because the overhead catenary wires and wayside power distribution system (including substations) will have to handle the higher electric load of multiple electric locomotives that would be necessary to pull the much longer and heavier US freight trains.

Operational Issues

- Trains would need to "change out" power at specified locations before coming into southern California – remove diesel locomotives and change to electric locomotives entering the Basin and vice versa leaving the Basin. Given current land constraints which are not anticipated to change, changing out locomotives from diesel to electric (or electric to diesel) at Yuma and Barstow will create choke points/bottlenecks, as trains that would normally proceed through would be brought onto very long service tracks to wait for one set of locomotives to be removed and another set to be added. This delay would mean that the capacity on the existing lines would be reduced because the trains will queue during the change out. The Railroads estimate approximately a 20-30% reduction in overall corridor capacity. This would also create economic waste as diesel and electric locomotives stand idle and unused at such points in between assignments.

- A "local" electrification scheme would create major inefficiencies in the use of locomotive assets. A key aspect of SCAG's electrification proposal is ensuring that rail shipments continue to improve in terms of efficiency. To the extent that electrification creates more bottlenecks and results in the diversion of traffic to trucks, the emissions associated with goods movement would go up rather than down.

- Contrary to what some have proposed, the Railroads would not operate trains utilizing both electric and diesel locomotives in excess quantities. Towing the un-needed diesel locomotives into an electrified zone in southern California would be incredibly inefficient from both a fuel and an asset utilization perspective– it simply does not make business or environmental sense. However, current train yard and locomotive servicing facilities at Barstow and Yuma cannot accommodate a large increase in locomotive entrainment (storage of locomotives and trains). It is not clear that there is room on land currently owned by the Railroads to build staging tracks (which would need to be several miles long) to hold waiting trains or to leave diesel and electric locomotives. It is also unclear if the Railroads could procure additional adjacent land.

- Crew and personnel factors must also be considered. Train crews are regulated by strict Federal Railroad Administration (FRA) regulations regarding hours-of-service, which are carefully recorded and monitored by federal inspectors. Currently, a crew can generally travel from Barstow or Yuma to the Ports within the FRA "on-duty" time limit of 12 hours. However, if the Railroads must stop a train to change from diesel to electric locomotives (and vice-versa) at Yuma and Barstow— the crews will not be able to make it to/from the Ports within the FRA time limit and an otherwise unneeded crew change will be necessary. This could double crew costs and increase the time required for the change over.

- Intermodal, manifest, and bulk trains are all increasing in weight and length. BNSF Railway (BNSF) and Union Pacific Railroad (Union Pacific) are both running 12,000-15,000 foot trains using distributed power units (DPUs) that require locomotives be dispersed at the front-end and throughout the train. Changing out the diesel locomotives on these trains would require head-end and mid-train or rear end power changes—up to two or three consists per train. Therefore, both the locomotives in the front, middle, and/or back of the train will need to be changed out which will increase the number of locomotives needed and the costs.

Costs

SCAG's Draft Business Plan and the Draft RTP's Report of Findings only include construction costs and the costs of purchasing new electric locomotives. SCAG ignores the following costs:

- Electrification of freight lines in Southern California cannot be limited to the South Coast Air Basin and must be comprehensive in scope in order to reduce disruptions to operations and attempt to maintain current efficiency levels. The Railroads' change crews, service trains, maintain locomotives, etc. at key "hubs" within their multi-state systems. This generally means that in order to create an electrified system that approached the efficiencies contained in the current system, one would need to electrify the freight lines, at a minimum, from the Ports of Los Angeles and Long Beach to Barstow for BNSF and to Yuma Arizona for Union Pacific, as well as possibly the lines to San Luis Obispo, Yermo and Bakersfield. Electrification of this magnitude in Southern California has never been studied, and given the urban landscape and the environmental requirements of California Environmental Quality Act, such a project scope would greatly increase the cost of electrification into the many tens of billions of dollars.

- The Railroads will have to build redundant service facilities for electric locomotives. BNSF will have to significantly expand the locomotive servicing facility at Barstow, but with current limitations it is unclear where this would be located. Union Pacific's existing diesel maintenance facility is located in the South Coast basin. Union Pacific's choices are to either 1) build new diesel and electric servicing areas at Yuma and leave their existing facility at West Colton as a stranded asset, or 2) drag "dead" diesel locomotives to the existing facility to be serviced (highly inefficient).

- SCAG only includes electrification of the main line tracks (the Railroads do not believe it is possible to erect wire in the existing intermodal yards in Southern California as the cranes that load containers load from above). Therefore, the Railroads would still have to use diesel locomotives in their yards and maintain some diesel maintenance capabilities for switch and local locomotives.

- Revenue loss during construction is not addressed by SCAG. SCAG does not estimate the loss of revenues due to loss of railroad operations during construction. The original 1992 Electrification Study indicated that this cost would be much higher in Los Angeles than in the North East Corridor since the LA lines operate 24 hours a day. In the North East Corridor, construction was focused during evening periods when no passenger commuter trains operated (and, the North East Corridor itself is about 95% passenger-only operation).

- Revenues will be lost due to operational inefficiency of electrification and increased switching. Electrified freight rail would become less desirable as transit times increase—making rail less competitive with trucks.

- Railroads will incur increased maintenance costs without a comparable increase in asset utilization for maintaining duplicative fleets of electric locomotives (and overhead wires) in addition to existing diesel locomotives.

- Railroad crew costs will increase as will training costs.

- Cost of "dead heading" diesel or electric locomotives.

- Cost of maintaining the catenary wire are not accounted for in SCAG's analysis.

- Safety costs are omitted. There would be a need to fence and build grade separations along a portion of the electrified portion of the track— these costs are not accounted for by SCAG and are significant as one grade separation can cost tens of millions of dollars.

- The electromagnetic field from the catenary will likely interfere with the existing signal system and may interfere with trackside communications including telephone service. Yet to be identified changes will have to be made. Since the traction current is grounded through the rails in an electric system, the Railroads anticipate almost a total reworking of the signal circuitry; costs are unknown.

- Fully electrifying Southern California mainlines will require rebuilding (increasing overhead clearance) of tunnels on the coast and Saugus lines and rebuilding many large steel truss bridges in the Basin to create adequate clearance for the high voltage wire. This is a huge cost and current freight volumes do not justify this level of investment.

In addition, SCAG understates the following costs:

- SCAG's current estimate of $2.5 M per freight locomotive is inconsistent with the 1992 Electrification Study which indicated that the cost would be approximately $4.0 M per locomotive in 1992 dollars. Due to the small size of the US locomotive market (1,300-1,400 locomotives produced in 2007 for all of North America), designing and procuring a small number (about 350) of electric locomotives will be considered a small, custom order and therefore expensive. New Tier 2 diesel locomotives are about $2 M; high Hp passenger electric locomotives on the east coast are $5-6 M; the Railroads expect electric locomotives for Southern California to be even more especially given the fact no new *freight* electric locomotives have been built in North America in more than 25 years.

- Entraining at Barstow and Yuma will be more expensive than outlined by SCAG. Both Railroads would need additional trackage to stage the trains when switching out the diesel for the electric locomotives. Preliminary estimates are that each Railroad would have to build at least six sets of track of the mainline approximately 10,000 feet long.

- SCAG staff's construction cost estimate of $10.6 M per track mile is inadequate. Tracks must have 25 foot clearance for 50,000 volt overhead wires and one average grade separation alone in the South Coast Basin costs $16 M. Also, open truss bridges will most likely have to be replaced (with girders on side of bridge) as there is not enough vertical clearance for the catenary.

Electricity Supply and Demand

SCAG's Draft Business Plan provided the American Public Transportation Association's published "heavy rail" power consumption rate of 5.83 kilowatts per vehicle mile. This likely significantly underestimates power needs as this is the demand for transit or light rail passenger-or-commuter trains, while the power requirements for US freight rails would be larger by orders of magnitude.

In addition, the following important questions need to be addressed:

- How much power will be needed to operate the electrified freight rail system during both peak and non-peak hours?

- Where is the power source for the rail system?

- Will the supply be able to support the large unbalanced electrical demand at all times day and night during the year (especially during peak summer and winter electricity demand periods)?
- Train will not operate when there is insufficient electricity supply and the Railroads cannot be artificially limited to operating electric–powered locomotives only during "off-peak" hours for the power grid. Will there be a guaranteed level of power availability?

Thank you for the opportunity to provide comments. If you have any questions or concerns, please call me at 415-215-4213 x 12 or Peter Okurowski at 925-339-3500.

Sincerely,

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